Description

Resource-saving broadband connection setup with appropriate call charging

The present invention relates to a communication system and a method for establishing a multimedia connection between two or more subscribers by means of switches in a communication network and a method for charging for a broadband connection.

Unlike private networks such as PBXs, public telephone networks operate on a connection-oriented basis. Before the actual data exchange between the subscribers, connection setup takes place in which the path through the network is specified and the required resources such as circuits, channels and bandwidths for these connections are reserved. The path through a communication network is specified within the switching system on the basis of the address supplied at connection setup and stored traffic routing data. At connection setup, the most favorable path for the connection through the network from the A-subscriber to the B-subscriber is determined according to pre-defined algorithms. After connection setup, the B-subscriber is called. The required or agreed bandwidth is possibly monitored during the connection to prevent overloads in the switches involved and in order not to appreciably limit the quality of the other connections.

Analogously to the reserving of channels and circuits in connection-oriented communication networks such as ATM networks (Asynchronous Transfer Mode), in connectionless networks such as IP networks (Internet Protocol) transmission and routing capacity is reserved for the required connection. This is necessary in such networks in order to be able to guarantee a specified QoS (Quality of Service) for the communication.

Multimedia services such as videophone and videoconference require broadband connections with bit rates of 1.5 Mbit/s to 100 Mbit/s or more. Connections of this kind generally contain a plurality of user data streams. Thus an audio and a video data stream are generally required for videotelephony, as the audio and video data are compressed using different compression methods with different compression rates, the video data stream requiring a higher bandwidth than the audio data stream despite compression.

If multimedia connections of this kind are established according to the procedure outlined above, which is described in Kalmanek, C. R.; DOSA: An Architecture for Providing a Robust IP Telephony Service, AT&T Labs, New Jersey, for Internet telephony, network resources are wasted, as the full bandwidth is reserved in the network or the broadband connection is already in place during calling of the B-subscriber (ringing of the videophone at the receive end). The network operator receives no revenue for this service, as charges are not payable until the B-subscriber accepts the call and the connection is put into operation. Likewise the case may arise that resources requested by the A-subscriber for setting up the broadband connection are not available to the network, the connection is not therefore established and the B-subscriber is not even called in the first place. This means lost revenue for the network operator and increasing customer dissatisfaction.

One approach for solving the problem is known from Sinnreich, H.; Interdomain IP Communications with QoS, Authorization and Usage Reporting, Internet Draft, Draft-sinnreich-interdomain-sip-qos-01.txt, 2000, in which the B-subscriber is called even though the connection is not yet stable in the network or the resources requested by the A-subscriber are not yet available.

However, it may happen that, when the B-subscriber goes off-hook, the connection is set up with a delay, with poor or not the desired quality, or not at all. In addition, ITU-T Recommendation Q.2962 of the International Telecommunication Union - Telecommunication Standardization Sector describes broadband ISDN signaling protocols that allow an A-subscriber to initiate the conversion of a minimum connection to a broader-band connection. According to this approach, the A-subscriber already possesses a minimum connection when he initiates the conversion. However, the A-subscriber cannot be prevented from requesting a broadband connection from the very outset, which means that the original situation with the associated problems described above can therefore arise. According to ITU-T Recommendation Q.2962, the A-subscriber can specify, to the network or his switch, one or more alternatives for establishing the connection. Thus, if the resources are available, a broadband connection is established. However, if network resources are again reserved during calling of the B-subscriber, and if no resources are available for a broadband connection, only a minimum connection is established which is not subsequently converted to a broadband connection.

The object of the invention is to create a communication system or a method for establishing a multimedia/broadband connection between subscribers in a communication network as well as a method for charging for a broadband connection which will enable a multimedia/broadband connection to be established in a resource-saving manner with appropriate call charging.

This object is achieved by the features of the independent claims. A broadband connection between subscribers is therefore only established by the network after a minimum connection has been set up between the subscribers and said

minimum connection has been put into operation by said subscribers. As a minimum connection is first set up and reserved, this ensures that if, for example, the called party is absent during the calling phase (ringing of the videophone at the receive end), no network resources for reserving a broadband connection are wasted. Nevertheless, a reliable, quickly established and fully adequate connection, the minimum connection, is available to the subscribers. This prevents the situation arising that no connection exists when the B-subscriber goes off-hook or the established connection is of poor quality. The subscribers can determine, via the minimum connection, what data is to be transmitted. This can include, for example, audio data for a voice connection or initialization data to receive-end playback or recording equipment whose data is then transmitted via the broadband connection. The minimum connection can be automatically converted to a broadband connection or an additional broadband connection can be automatically set up by the network or even initiated by the subscribers themselves. However, as the communication network or the switches control the multi-stage connection setup, establishment of a broadband connection without the prior setup and putting into operation of a minimum connection is prevented.

If an A-subscriber wishes to establish a broadband connection to a B-subscriber, e.g. without first establishing a minimum connection, the A-subscriber will be charged for broadband network capacities, which are reserved in the network at his request, as early as the calling phase (ringing of the receive-end videophone). The establishment of such connections can be granted a higher priority in the network than the establishment of broadband connections which are not charged for during broadband connection setup. Broadband resources that are reserved in the network on request will be paid for by the subscribers and used directly.

The invention will be further developed by the features of the dependent claims.

The present invention will now be explained using examples with reference to the accompanying drawings:

Fig. 1 shows a flowchart for the setup of a broadband connection according to the invention based on the example of videotelephony and Fig. 2 shows a flowchart for the setup and charging of a broadband connection according to the invention.

In ATM networks, for example, network resources such as transmission capacity on the physical circuits and ATM cell memory in the network nodes are distributed over virtual connections. The resulting flexible and efficient use of network resources is subject to the mutual interference between connections, particularly if the permissible network load is exceeded. Traffic control is based on a Traffic Contract concluded between a subscriber and the network, in which the subscriber, at connection setup, notifies the network of traffic parameters characterizing the required connection and undertakes to adhere to the agreements. In addition to the traffic parameters, the subscriber agrees QoS (Quality of Service) requirements with the network. The network decides whether the connection required by the subscriber can be accepted without impairment to the QoS of existing connections or new connections to be established.

In Fig. 1 shows the setup according to the invention of a multimedia connection from an A-subscriber to a B-subscriber based on a videotelephony example. With the "Setup" message, the A-subscriber A-Tln informs his switch A-Vst that he wants to set up a connection with the B-subscriber B-Tln. The "Setup" message contains the request for a multimedia

connection with a 64 kbit data stream for the transmission of audio data and a 2 Mbit data stream for the transmission of video data. The switch A-Vst, however, only transmits a "Setup" message for the establishment of a minimum connection for the 64 kbit audio data stream to the B-subscriber's switch B-Vst. The B-subscriber's switch B-Vst sends the B-subscriber B-Tln a "Setup" message for a 64 kbit audio connection, whereupon the B-subscriber's terminal is busied. If resources are available for the 64 kbit audio connection, in the next step the 64 kbit audio connection is set up and reserved. The B-subscriber B-Tln is called (ringing of the receive-end videophone). If the B-subscriber B-Tln goes off-hook, an "Answer" message is sent from him to the A-subscriber A-Tln via the switches A-Vst and B-Vst. The 64 kbit audio connection between the A-subscriber A-Tln and the B-subscriber is put into operation and charged for. Thereafter the switch A-Vst initiates setup of the 2 Mbit video connection and sends a "Setup" message for the establishment of the 2 Mbit video connection to the B-subscriber's switch B-Vst, whereupon the latter sends the B-subscriber a "Setup" message for the establishment of the 2 Mbit video connection. As soon as the necessary resources for the 2 Mbit video connection have been granted by the network, the connection is put into operation and charging is adapted accordingly. Several attempts may be necessary or permissible depending on circumstances. This allows greater capacity utilization of the network or means that the network requires little or no overdimensioning. A time delay in providing the video connection is acceptable, as communication between the subscribers A-Tln, B-Tln is already possible via the audio connection.

According to the invention, the data to be transmitted even via the minimum connection can be specified in the "Setup" message from the A-subscriber A-Tln to his switch A-Vst. This is advantageous if, prior to transmission of broadband information, initialization data has to be transmitted between the subscribers A-Tln, B-Tln and said information can be transmitted even via the minimum connection.

It is additionally possible for the A-subscriber A-Tln to himself initiate setup of the broadband connection when required, instead of the switch A-Vst of the A-subscriber A-Tln setting it up automatically when the minimum connection is put into operation.

Fig. 2 shows an example of the setup and charging of a multimedia/broadband connection according to the invention. In this example a broadband connection is established from the A-subscriber A-Tln to the B-subscriber B-Tln, without a pre-existing minimum connection. The A-subscriber A-Tln can communicate this requirement to his switch A-Vst in the "Setup" message. The switch A-Vst receives from the A-subscriber in the "Setup" message the request to establish a 2 Mbit multimedia connection and forwards said request in a similar manner to the example shown in Fig. 1. If the resources for setting up the 2 Mbit multimedia connection are available to the network, the 2 Mbit multimedia connection is reserved and charged for. The B-subscriber B-Tln is called. If the B-subscriber B-Tln goes off-hook, an "Answer" message is sent by him to the A-subscriber A-Tln via the switches A-Vst and B-Vst. The 2 Mbit multimedia connection between the A-subscriber A-Tln and the B-subscriber is put into operation. The setup of such connections can be granted a higher priority in the network than the cleardown of minimum connections in favor of full connections or the establishment of broadband

connections which are not charged for during the broadband connection setup phase.